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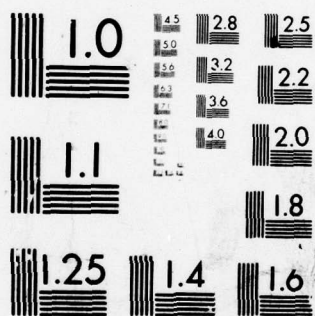
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DEVELOPMENT OF SMALL COMBAT ARMS UNIT LEADER TACTICAL TRAINING TECH- NIQUES AND A MODEL TRAINING SYSTEM

Edgar L. Shriver, Donald R. Jones,
David L. Hannaman, and Glenn R. Griffin
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and

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Army Research Institute



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ENGAGEMENT SIMULATION TECHNICAL AREA



U. S. Army

Research Institute for the Behavioral and Social Sciences

July 1979

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learn tactical skills which they would later apply during REALTRAIN exercises with troops.

However, for best results leaders appeared to need to learn to work with their noncommissioned officers (NCOs) and then to practice in the field, both with and without troops. A variation of the basic game enabled the unit team of platoon and squad leaders to work together on the game board as they would during an actual engagement.

Concurrently, a field training technique, focused on leader/subordinate interaction, was explored. The field opposition exercise involved only key leaders on each side, without troop support.

A combined arms mapboard game was also developed to help familiarize junior officers with the nature of tactical operations that integrate mechanized infantry, armor, and anti-armor elements against a deployed enemy.

The research summarized in this report has produced (a) an infantry squad/platoon level mapboard game for two-player or multiplayer use; (b) an infantry squad/platoon level field opposition exercise; and (c) a combined arms platoon/company level mapboard game. Separate documents are available on each of the three training techniques.

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Research Report 1219

DEVELOPMENT OF SMALL COMBAT ARMS UNIT LEADER TACTICAL TRAINING TECH- NIQUES AND A MODEL TRAINING SYSTEM

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**Tactical Skill Acquisition
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DEVELOPMENT OF SMALL COMBAT ARMS UNIT LEADER
TACTICAL TRAINING TECHNIQUES AND A MODEL TRAINING SYSTEM

FOREWORD

The U. S. Army Training and Doctrine Command (TRADOC) has identified small unit tactical engagement simulation training as one of its highest behavioral science research priorities. Research initiated by the U. S. Army Research Institute for the Behavioral and Social Sciences (ARI) in 1972 has led to the development of a family of tactical engagement simulation training techniques, including Squad Combat Operations Exercises (Simulation) (SCOPES) and REALTRAIN.

Early in this research program it became evident that special tactical training techniques were necessary for training the leaders of small combat arms units. Often field exercises requiring full units were found to provide training mainly for officer and senior NCO personnel and to provide little effective training for lower level troops. This led to the development of tactical training techniques specifically directed at the training of small unit leaders. The first techniques developed were a board game and a field opposition exercise involving only leader personnel (using engagement simulation procedures) for infantry squads and platoons.

Army doctrine emphasizes the importance of the integration of mechanized infantry, armor, and anti-armor elements into a combined arms force. Therefore, a combined arms mapboard game that would provide officers with the opportunity to become familiar with the nature of these combined arms operations was also developed.

This research was part of a larger research program designed to improve tactical training in units. The entire program has been responsive to the requirements of RDTE Project 20763743A773 and, at its inception, the Combat Arms Training Board (CATB) which is now the TRADOC System Manager for Tactical Engagement Simulation (TSM-TES) of the TRADOC Training Support Center. The research reported here augments board game developments accomplished by the Combined Arms Training Developments Agency, Fort Leavenworth, Kansas.

Joseph Zeidner
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EXECUTIVE SUMMARY

Army-wide introduction of SCOPES and REALTRAIN engagement simulation as tactical training techniques provided the Army methods for tactically training small infantry, armor, and anti-armor units under conditions approaching those of real combat. In engagement simulation tactical training exercises, platoon, squad, or combined arms team size units can engage in free play exercises, actively opposing forces that have been given a conflicting mission in order to insure contact between the two forces.

The simulated combat environment provided by SCOPES and REALTRAIN places on the small unit leader many of the heavy behavioral demands of actual combat. Leaders must make decisions quickly regarding events that are occurring in real time as a joint function of the actions being taken by both sides. Individual tactical skills that must be learned by the small unit leader include: anticipation of enemy actions, planning concerted actions against the enemy, placing personnel in locations most likely to give them an advantage over the enemy, planning for use of the most effective weapons in a given situation, command and control, and contingency planning as more information about enemy and friendly actions is received. Simulation of combat provides a series of specific situations for small unit leaders to learn what are and what are not effective tactical behaviors.

Even during the initial development of the first engagement simulation techniques by a joint ARI, TRADOC and contractor team, it became evident that the training of small unit leaders required special research attention.

While earlier REALTRAIN developments provided effective and motivating tactical training for troops, research was needed to develop related techniques for unit leaders in the maneuver arms. Often field exercises requiring full units provide training only for officer and senior NCO personnel and may be counterproductive in terms of lower level troop training and motivation.

The objective of this research project was to develop and evaluate simulation techniques for training small unit leaders which would provide the maximum tactical decision-making training while minimizing the unnecessary, and often wasteful, participation of lower level troops.

The fundamental approach of this research effort has been to take some of the basic instructional principles underlying the REALTRAIN method and to develop abstractions of field exercises for leader training.

Initial efforts led to the development of a mapboard game. The concept of "board games" has a great deal of intuitive appeal:

- They may be used to simulate (to varying degrees of abstraction) "real world" situations.
- They minimize the requirement for equipment resources.
- They minimize the requirement for "expensive" personnel resources.
- They may be reproduced relatively inexpensively.
- They may be used as part of formal training or informally during a soldier's free time, if he so desires.
- "Games" are inherently motivating because of their competitive aspects and the interpersonal interactions involved.

The "board game" initially developed was a two-sided, free-play map exercise for teaching infantry tactics to small unit leaders at the platoon level. As originally conceived, junior leaders could play the game to develop tactical skills which they would subsequently apply during REALTRAIN exercises with troops.

Preliminary tests of this gaming technique showed it to have value in providing infantry officers an opportunity to practice tactics in response to realistic, real-time demands of combat situations. It was found, however, that for the benefits of this training to be fully realized, leaders had to have an opportunity to learn to work with their NCOs and then to practice what they had learned in the field both with and without troops. Therefore, a variation of the basic game simulation was developed which permitted the unit leader team (platoon and squad leaders) to work together on the game board as they would during an actual engagement.

Concurrently with the development of the multi-person infantry mapboard game, the development of a field training technique that would further focus on leader/subordinate interaction processes was explored. A small unit leader field opposition exercise involved only key leader personnel (without troop support) on each side was developed. The rationale for the development of the exercise was that it would provide training for leader/group interaction processes in a way that the mapboard games did not and could not. It was recognized, however, that the conduct of the field opposition exercise would be somewhat more expensive in terms of time and resources than would either of the two mapboard games, although less expensive than full-scale engagement simulation exercises.

Current Army doctrine emphasizes the importance of the integration of mechanized infantry, armor, and anti-armor elements in conducting successful tactical operations against a deployed enemy. Therefore, a combined arms mapboard game was also developed that would provide junior officers with the opportunity to become familiar with the nature of these combined arms operations.

The products of this research have been: (1) an infantry squad/platoon level game for two-player or multi-player use; (2) an infantry squad/platoon level field opposition exercise; and (3) a combined arms platoon/company level mapboard game. This report summarizes the research activities conducted in the development of these research products. Separate reports document each of the three training techniques.

DEVELOPMENT OF SMALL COMBAT ARMS UNIT LEADER TACTICAL TRAINING TECHNIQUES AND A MODEL TRAINING SYSTEM

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DEVELOPMENT OF SMALL COMBAT ARMS UNIT LEADER TACTICAL TRAINING TECHNIQUES AND A MODEL TRAINING SYSTEM

INTRODUCTION

This report summarizes a series of activities conducted over a four-year period devoted to the development of small unit leader training techniques that do not involve full troop complements. These techniques were developed to provide an efficient, relatively inexpensive means of preparing small unit leaders for full-scale engagement simulation exercises. The introduction of engagement simulation as a training technique provided a method for the Army to train small ground units (infantry, tank, anti-tank) under conditions approaching those of real combat.

In engagement simulation, platoon, squad, or team size units engage in free play exercises, actively opposing forces that have been given a conflicting mission in order to insure contact between the two forces.

The simulated combat environment places the types of behavioral demands on the small unit leader that actual combat does. They must make decisions quickly in real time regarding events that are occurring in real time. The events in the simulated engagement situation do not operate by scenario, they occur as a joint function of the actions taken by both sides. The decisions made in each situation are based on these different events. The skill that must be acquired by the leader is that of generalizing the events from one situation to subsequent ones. This same skill of generalizing is acquired by combat experience, but in the simulated engagement the leader always survives to learn from his experience.

The individual skills learned from experience are easily described at a high level of abstraction; they include anticipation of enemy actions, planning concerted actions against the enemy, placing personnel in the places most likely to give them an advantage over the enemy, planning for use of the most effective weapons in a given situation, command and control, contingency planning as more information about enemy and friendly actions (events) come to him, etc. But these abstract levels of description are at too high a level for training purposes. The simulations of combat provide a series of specific situations for small unit leaders to learn what are effective and not effective actions--at a level of abstraction that is analogous to combat experience.

The engagement can also be simulated in two-sided mapboard exercises with only leaders participating. This type of simulation represents an abstraction of full-scale engagement simulation. Without troops on the ground being led not all leader skills can be represented. But a sufficient number can be acquired in the mapboard game to improve a leader's performance significantly in the engagement simulation situation with troops on the ground.

Since the mapboard situation requires only a fraction of the time and resources that engagement simulation requires, it is an efficient training alternative. A mapboard game that trains participants in 80% of the skills at 10% of the cost of full-scale engagement simulation is efficient. It is not more effective, but it is efficient.

The sine qua non of the simulation situation is that it presents the leaders with specific situations over which they have only partial control and partial information. An old rule of thumb is that the closer the simulation is to the real thing the better. But restrictions of time and other resources must be considered in determining cost effectiveness in a training situation. The type of mapboard situation which proves to be effective and efficient has been the subject of study in the research reported here.

From the activities described in the report, it is clear that these efforts did not include a rigorous, empirical evaluation of a series of training techniques. Rather, most of the evidence cited is based on the observations and hypotheses made by the Contractor, ARI civilian research personnel, and military personnel who were involved in the training development effort. It is important that the methodological approach described in the report and the types of evidence cited be viewed as part of an overall research and development sequence in which observational/anecdotal evidence is appropriate in the early stages, and in which more rigorous, experimental evidence is called for in the later and final stages.

Within the past 15 years, the behavioral science community (Borg and Gall, 1971) has recognized the need for a "product development" methodology in order to build effective training programs. The massive training efforts during the war on poverty era of the early and mid-60s underlined the futility of rigorously evaluating programs that were still in the embryonic stages of their development. The educational research literature of the late 60s and early 70s is replete with reports of training programs that demonstrated "no significant differences" because they

were evaluated before the programs had had an opportunity to pass through the inevitable vicissitudes of the first several years of their existence.

As the result of lessons learned from the failures of the 60s, a developmental paradigm for training products (Popham, 1975) has emerged that generally includes the following basic stages:

1. A needs analysis (often referred to as a task or job analysis) in which the specific nature of a training problem or problems are identified and the training objectives for an intervention are specified.
2. A design stage in which the training model to be used is conceptualized and a blueprint for the actual product or products is formulated.
3. A developmental stage in which the "first draft" of the product is created. In this stage, the conceptualization of the product may be essentially complete, but the physical appearance of the product may be rough. The lack of polish in the physical product at this stage is purposeful in that expenditures to create a more polished product are almost never justified given the likelihood of numerous revisions.
4. A pilot test stage during which the developers of the product try out its efficacy in a controlled environment in which the developers play a direct and involved role in the administration of the product.
5. A revision stage in which observations made by the product developers (and members of the target population who tried out the product) are used to make improvements in the product. The developers may correct for certain rough spots in administration or product in order for the test to be completed. This is analogous to small group trials in the development of training materials.
6. A field test stage in which the product receives a more comprehensive evaluation than in the pilot test stage, and in which the product developers are less directly involved in its administration, though available to help solve administrative "glitches" that may occur.
7. Another revision stage in which observations on the part of developers and participants in the field test are used to make further improvements in the product.

8. An installation stage in which the product is introduced, on a limited basis, in the actual setting or settings for which it was originally intended.
9. A final evaluation stage in which the effectiveness of the intervention is rigorously determined and decisions concerning its continued use and further implementation are made by the sponsors or eventual users of the product.

Implicit in this sequence of developmental steps is an increasing degree of sophistication and rigor in the evaluation methodology. In the very early stages of product conceptualization, the evaluation that occurs simply involves developmental team members expressing their reactions and opinions to each other's ideas especially in response to their own participation in the process. In the final evaluation stage, an experimental design that meets the standards of rigor and quality which can be found in Campbell's and Stanley's now classic book (1966) is implemented. The observational and anecdotal evidence which constitutes the bulk of evaluation methodology between these two extremes forms the basis for many of the inferences and conclusions drawn in this report.

In a 1975 article in the American Psychologist, Lee J. Cronbach, one of the most prolific contributors to behavioral science research methodology in the last 25 years, strongly advocates this observational approach to behavioral science inquiry. Cronbach even suggests that this approach can shed more light on the nature of outcome data than can more rigorously and tightly controlled experiments in which effects that do not achieve statistical significance are rejected at the expense of uncovering important relationships between variables. Cronbach's argument seems especially germane to the developmental effort described here in that combat situations are highly complicated phenomena where situational variables have a major effect on the outcome of battles and the success of particular techniques and strategies.

Cronbach does not cast his remarks in the context of training development methodology. However, it seems clear that his ideas are consistent with the nature of inquiry that occurs in what Popham (1975) and others have called formative evaluation. Formative evaluation generally includes all the developmental stages up to and including the field test and subsequent revision of a product. Hence the evaluation tests attempt to uncover as many reasons as they can that the product works under certain conditions, and not under others. As Cronbach puts it, the evaluators are playing a "journalistic" role in which they observe, describe, infer, and recommend. Although they strive for objectivity, they are necessarily partisans and advocates of the training product, for they are committed to insuring that the product achieves its training goals.

Clearly, the activities outlined in this report fall within the formative evaluation domain. None of the products described herein has yet been submitted to what Popham (1975) and others have called summative evaluation. Summative evaluation generally occurs after products have been installed. Hence, the evaluators are almost always a different group from the product developers and formative evaluators. They are non-partisan and dispassionate, and their purpose is to determine, using more classical experimental design procedures, whether or not the goals of the training product have been achieved.

The following section of the report describes the developmental progress made to date for five types of training techniques and two model training systems. Each technique represents a different level of developmental "maturity" with respect to the nine stages outlined above. Some are almost ready for installation in the Army's on-going training system. Others still require further pilot and field testing and revision. Each has undergone the type of careful developmental planning and building required before a rigorous summative evaluation can be justified.

METHODOLOGY

DEVELOPMENT OF INFANTRY MAPBOARD GAMES

Development of Two-Person Infantry Mapboard Game. The first training technique developed was an infantry mapboard game that allowed officers to conduct battle operations in a simulated tactical environment. The game was designed to support the following skill/knowledge areas:

1. Weapons effects for both direct and indirect fire weapons
2. Terrain analyses
3. Processing information received as a result of passive and overt enemy cues (e.g., observation of an enemy bunker position or contact with an enemy patrol)
4. Developing operational plans
5. Developing contingency plans in response to unexpected situations.

The mapboard game was designed to include a number of characteristics that simulate actual combat situations and place similar demands on leaders. In the game, as in combat, the leader receives a mission around which he must develop an operational plan. The mission is executed against an intelligent opposition force with a counter mission of its own. The exact disposition and actions of each side are not fully known to the leader of the other side. In executing his plan the leader receives information about the enemy through contact with an enemy force or by observation of the enemy forces, if his personnel are in a position to acquire information. After execution of the plan begins, the leader's actions are based on his assessments of contact with, or observation of, enemy forces.

Major mechanical aspects of the original two-person infantry game were as follows:

1. Two players opposed each other. Each had an identical game board made from a blown up terrain map. The players were separated by a partition that prevented them from observing each other's moves.

2. Playing pieces were made of cork treated with an adherent substance so that they could be easily placed on and moved about the game board surface. Different colored pins inserted in the cork represented the complement of soldiers and equipment for playing pieces, including normal T&E capabilities, personnel, and weapons.
3. Players were given opposing missions. Each was expected to accomplish his mission through movement of game pieces and use of associated weapons.
4. A controller, who could observe both game boards, gave appropriate cues to each player when the position of player pieces dictated that a cue be received. For example, when a defending player's observation post was approached by an enemy patrol, the controller told the defending player what the OP would have seen in an actual battlefield situation. If 20 troops approached the OP in semi-wooded terrain, the controller might have said, "Your outpost has observed four enemy troops." In this situation, the controller determined that all the enemy troops were not visible to the OP, and therefore did not provide information on the actual number of troops approaching the OP.
5. In order to provide appropriate cues, controllers were required to make accurate judgments with respect to (a) what could be seen by player pieces, (b) what could be hit by various types of weapons, and (c) what casualties were sustained as the result of these hits.
6. The controller performed the additional functions of placing indirect fire and assessing casualties. The controller assessed casualties through consideration of four factors: troop movement, troop disposition, weapons involved, and terrain. For example, if a 3-man point element moving in a single file at 25mm apart through wooded terrain were engaged by an M60 machine gun from a bunker, the controller might assess only the lead man as a casualty. If the same movement occurred in open terrain, all three men would be assessed casualties. If the same 3-man point element were moving through wooded terrain in a wedge formation, 10mm apart, all three would be assessed casualties.
7. The game continued until the controller determined that one player had rendered his opponent ineffective. For example, the game might end when the defending force had suffered excessive casualties and was no longer an effective fighting unit.

8. At the termination of each game, the controller briefly reconstructed the battle for both players, and pointed out the significant player decisions that led to victory or defeat.

Following initial development, tryouts were initiated on the game to determine its realism and credibility, and to make substantive suggestions on ways it could be improved.

During developmental plays of the game, participants with previous combat experience reported that they felt they were learning skills needed in battle. The importance of the controller in making the game an effective learning experience was recognized. It was essential that he make accurate observations and correct interpretations of those observations, in order to provide cues to opposing players. It was evident that the controller had to have learned weapon effects, casualty assessment, movement distances, etc., better than the players in order to keep the game moving.

Pilot Test of Two-Person Infantry Mapboard Game. Two pilot tests of the infantry mapboard game were held in March 1974. The pilot tests were conducted in two locations--Marine Corps School at Quantico, Virginia and the Army Infantry School at Fort Benning, Georgia. Twelve Marine Corps Second Lieutenants and ten Army Second Lieutenants comprised the pilot test samples.

There were four major purposes for conducting these pilot tests:

1. Infantry Second Lieutenants for whom the mapboard game was designed have only a doctrinal understanding of their roles in combat at that stage of their professional development. Reactions of Second Lieutenants to a training technique for skill development using mapboards was desired.
2. Information was needed on any aspects of the game that the Lieutenants felt did not accurately simulate actual battlefield conditions.
3. The specific nature of the training benefits that the Lieutenants believed the game provided needed to be identified.
4. Specific suggestions were desired on how the Lieutenants thought the game could be improved.

Both tests were conducted in the following steps:

1. The game was introduced to the Lieutenants by the research staff who explained the nature of the game's activities and the overall purpose of the game.
2. Game play was initiated with research staff members serving as controllers and Second Lieutenants assuming the two player roles.
3. Each Second Lieutenant began his participation in the test by playing the game. He then assumed the role of the controller for one play of the game to provide him with an overview of the game's structure. He played a second game to reinforce his overall understanding of the game, combining his experiences of playing and controlling the game.
4. After each Lieutenant had played two games and had served in the role of the controller, he was asked to participate in an informal discussion with the research staff to give his opinions on the game. Each Lieutenant was asked to give his opinions about the realism of game rules and to identify the ways in which the game could be improved. He was also asked to state specifically what he liked and disliked about the game and what particular benefits he felt he had received from the game.

The following is a summary of the Lieutenants' (Marine Corps and Army) reactions to the game:

1. In discussing what they felt they had learned as a result of playing the game and serving as controller, the Lieutenants stressed three major points.
 - a. The game forced them to think about the disposition and intent of the enemy in order to plan their own actions.
 - b. The game provided them with some helpful practice in coordinating artillery support with their own ground movements.
 - c. The game was helpful in providing practice in the planning of combat operations appropriate to their command level, especially in positioning troops and weapons.

2. The Lieutenants felt that the game needed improvement to reduce the subjectivity involved in the controller's role. They noted variability from controller to controller in the translation of enemy disposition and movement into cues provided to an opponent. They also noted inconsistency in casualty assessment, e.g., in a similar situation, one controller assessed four casualties and another assessed two.
3. The Lieutenants made a number of suggestions regarding the mechanics of the game. They felt that the game was too long and that changes needed to be made to quicken its pace. They suggested that a better method be devised for verifying distances on the game board surface. They felt that the blown up grid squares did not provide sufficient information for accurate estimation of prescribed movement and distances. Several felt that the game pieces were awkward.
4. Almost all of the Lieutenants questioned the delivery time of artillery fire and the casualty effects of that fire.

Revision of Two-Person Infantry Mapboard Game. Following the pilot test activities there were two major objectives for the revision of the mapboard game:

1. Improve definition of the rules by which controllers made their judgments.
2. Shorten the time required to play the game.

In order to accomplish these objectives the following procedures were developed.

1. An indirect fire casualty assessment table was designed. Figures for the table were obtained from appropriate field manuals provided by the Gunnery Department, the Artillery School, Fort Sill, Oklahoma. The table was designed to enable the controller to determine the percentage of casualties resulting from various types of indirect fire. Figures were computed according to troop location in the sheaf, type of cover, type of round, and number of rounds. Different overlays (e.g., 81mm and 155mm) were designed to determine accurately the number of troops in a particular type of sheaf.

2. The delivery time of artillery was verified with the Artillery School.
3. A direct fire manual established procedures for determining casualties for various types of infantry weapons (including mines). Unlike the indirect fire table, the procedures for determining casualties for this portion of the manual varied for each type of weapon. Characteristics of the weapon and distance to target were the basis for developing casualty assessment rules. The roll of a six-sided die permitted a standard means of assessing casualties.
4. In order to make playing pieces more maneuverable, colored metal nuts mounted on spikes were made to replace corks and pins.
5. A voice communications system using plastic tubing and earphones was developed to replace note passing as the primary means of communication between controller and players.
6. A controller handbook was assembled to provide a single reference source for reviewing controller duties before game play, and as a quick reference for answers to questions arising during game play.

Each of the new procedures was introduced, and a plan was formulated for a field test of the games effectiveness in preparing small unit leaders for simulated combat.

Field Test of Two-Person Infantry Mapboard. The field test for the game was conducted with the 9th Infantry Division, Fort Lewis, Washington, in August 1974. The major objective of the test was to determine the training effectiveness of the infantry mapboard game through a field performance evaluation of officers with game experience against officers without game experience in an engagement simulation training environment.

The sample of officers for the test consisted of five Lieutenants designated as experimental participants and five Lieutenants designated as controls. Test administration and support personnel were four contractor staff members, two ARI staff members, 55 enlisted personnel who served as troops used in the engagement simulation battles, and 15 enlisted personnel who were controllers for the engagement simulation exercises.

Design of the Test. The five officers from the experimental group played the mapboard game for seven days and interacted with the troops designated for participation in the test for a period of two days in engagement simulation exercises. During the seven-day period, these officers averaged participation in eight games as player and two games as controller. The officers in the control group were provided copies of the Combat Leader's Field Guide and other appropriate manuals and were asked to review information pertinent to the rifle platoon in the attack and the defense. They received no additional training.

The same enlisted personnel were used as unit personnel by the officers in both the experimental and control groups. These personnel were rotated with each battle situation to preclude the opportunity of any officers gaining an advantage from extended practice with any one unit of troops. The rotation of troops also prevented any officer from gaining an advantage through working with more experienced troops.

The experimental group participated in five attack and five defensive operations against units commanded by an officer in the control group. The ten battles were conducted over different types of terrain, and each battle scenario provided for a platoon in the attack against a platoon (-) in the defense. A standard ratio of forces (3 to 1) in favor of the attacking platoon was established for the engagement simulation exercises.

The measure for evaluating the effectiveness of the mapboard game was the total number of battles won by the experimental group versus the total number of battles won by the control group. A given unit was considered a winner of a battle when they had rendered the opposition ineffective as a fighting force. Use of an arbitrary number of casualties (e.g., 30% or 60%) was rejected as a means of determining when one side was no longer an effective fighting force. Instead it was decided to allow battles to continue until total annihilation of one side was achieved, even though it was recognized that in some cases battle would be allowed to continue longer than they would be sustainable in actual combat.

Units led by officers in the experimental group won eight out of ten test battles. These officers won five out of five defensive operations with an average casualty rate of 33%. They won three out of five attack operations with a very high casualty rate of 85%.

During each battle, personnel at a central control station maintained a record of all actions and their time and location of occurrence. This information, supplemented by observations made by ground controllers, permitted a detailed reconstruction of each

battle. These battle descriptions were prepared in the form that military writers and illustrators use for documenting battles. A number of the battle descriptions were analyzed to identify "effective" and "ineffective" behaviors on the part of both officers in the experimental group and officers in the control group. An effective or ineffective behavior was identified as any specific, observable act, or lack thereof, on the part of an officer which either enhanced, or decreased the chances of that officer's success in battle. For example, an effective behavior in planning for the defense might be identified as "establishing forward security for early warning." An ineffective behavior for the same officer might be identified as "not planning for preplanned artillery fire as part of his defense."

This analysis revealed that the primary differences between officers in the experimental group and officers in the control group in exhibiting effective and ineffective behaviors occurred in the planning and execution phases of defensive operations. The officers in the experimental group exhibited many more effective behaviors in these phases than did officers in the control group. Differences between officers in the experimental group and officers in the control group were less pronounced in attack operations, especially in the execution phases.

The above-referenced analyses can be found in the Appendix.

Observations. It appeared from the results of the test that the mapboard game was most effective in preparing leaders for the planning and execution phases of defensive operations. The game was less effective in preparing leaders for the planning and execution phases of offensive operations. Several hypotheses were advanced for these differences:

1. The mapboard game provided leaders practice in developing a number of different options that are associated with the execution of defensive operations. In the board games, officers learned to plan defenses which would require their troops to initiate a preplanned action upon enemy contact. In the subsequent engagement simulation exercises the officers in the experimental group appeared to take advantage of their experience by instructing subordinates before the battle precisely what to do when enemy contact was made. As a result their troops did not have to consult them prior to taking immediate actions against the enemy.

2. The game provided officers practice in analyzing terrain, especially in anticipating possible avenues of approach by the attacking force and planning for effective positioning of defensive elements.
3. The game provided officers practice in coordinating supporting artillery with their defensive operations.
4. The game provided less practice in the attack than in the defense in developing specific plans for action. An attacking leader is much less aware of the position and intentions of his opponent than is a defensive leader. An attacking leader can provide security and artillery support to his maneuvering elements, but he cannot preplan the specific actions they are to take when contact is made, as a defensive leader can. Much more leader/subordinate interaction is required in offensive operations than in defensive operations. The leader must receive communications from his subordinates upon enemy contact; formulate new plans based on new intelligence; and communicate these new plans to the subordinates. The game did not provide leaders with practice in this type of on-the-spot planning and immediate communications with subordinates, as there were no subordinates in the games.

It was concluded that the mapboard game had provided experimental officers with good preparation in many skills critical to effective battlefield performance, but not in all skills. The major area in which the game failed to provide practice for skill development was in leader/group interaction processes and communications. Plans were formulated to revise the mapboard game to provide more practice in the area of leader/group interaction processes, and to investigate other possible training techniques that would address this area.

Development of Multi-Person Infantry Mapboard Game. In the fall of 1974, following the Fort Lewis field test of the infantry mapboard game, effort was concentrated on developing procedures for introducing leader/subordinate interactions into the game. This required adding subordinates as players and developing procedures by which they could realistically practice interacting with leaders in planning and executing tactical operations. In addition, better means for exercising the skills of map-to-ground association and accurate employment of indirect fire were needed.

A multi-person version of the infantry mapboard game was developed which was played by a leader and a subordinate on each side. A second controller was added to control the simulation of indirect

fire. In this game the subordinate on each side played all subordinate roles (ambush, point element, OP, and patrol). The subordinate received cues from the controller as game play developed and communicated appropriate information to the platoon leader. This additional level of interaction constituted the major difference between the two-person and the multi-person games. The following mechanics were used.

1. Subordinates and leaders were provided individual mapboards screened to prevent viewing by each other and by their opponents.
2. Players were required to communicate with each other by voice either through plastic tubing or a radio.
3. The practice of allowing leaders to observe their exact troop and weapon dispositions was discontinued. Leaders were now permitted only to observe that portion of the map immediately surrounding the platoon command post. Only controllers and the subordinate players were allowed to observe where pieces were placed. This change forced leaders and subordinates to interact in order for leaders to learn the locations of their subordinate elements.
4. Grid lines were removed from map playing surfaces of leaders and subordinates. This forced subordinates and leaders to refer to the grid coordinates on regular 1:25,000 terrain maps in order to identify and communicate locations.
5. Each controller was provided a map for plotting fire missions and disposition of player pieces.

Refinement and Documentation of Two Infantry Mapboard Games. Continued experience with the two infantry mapboard games highlighted the need for simplifying the role of the controller before the games would be workable in on-going unit training. The weapons effects manual had to be revised to simplify casualty assessment for direct fire weapons. Originally, different procedures were specified for determining the casualty effects of each type of weapon used in the games. For example, to assess casualties for the M203 grenade launcher the controller would roll a die and assess casualties by the die number rolled for each of ten rounds fired. If five rounds were fired, only one-half the number of

casualties indicated on the die would be assessed. Correspondingly, if 15 rounds were fired, one and one-half the die number would be assessed as casualties. This variation in procedure from weapon to weapon made rapid casualty assessment impossible and resulted in long interruptions of game play.

To correct this defect (1) the format for assessing direct weapons effects was changed to a table similar in concept to the indirect fire table and (2) the process for casualty determination for all weapons was standardized.

The new table was in the form of a slide rule. It presented in consolidated format three pieces of information for each weapon: (1) a hit probability; (2) a casualty probability; and (3) a detection probability. For any weapon being engaged, the controller checked the table for the distance of the weapon from the target, adjusted the slide rule for number of weapons or rounds being fired, and read the hit and casualty probability that appeared in a window beside the appropriate range. If the probability was less than one, a roll of the die would determine the chance of a hit. For example, if a player indicated that two M203 rounds were fired at a two-man point team, the controller would assess casualties by moving the slide rule to the number of rounds fired. He would then look at the column next to the appropriate distance (100m) and read a .8 probability. He would then roll a 10-sided die. If the die read 1-8 he would assess one casualty. If it read 9 or 0, he would assess a miss.

Manuals were written to document the two infantry mapboard games. The manuals were designed to include all information and rules necessary to permit the techniques to be implemented in Army training without research staff assistance.

DEVELOPMENT OF SMALL UNIT LEADER FIELD OPPOSITION EXERCISE

Concurrently with the development of the multi-person mapboard game, the development of a field training technique that would focus on leader/subordinate interaction processes was explored.

A small unit leader field opposition exercise using key leader personnel (without troop support) on each side was developed. The rationale for the development of the exercise was that it would provide training for leader/group interaction processes in a way that the mapboard games did not and could not. It was recognized, however, that the conduct of the field opposition exercise would be

somewhat more expensive in terms of time and resources than would either of the two mapboard games, although much less than required for engagement simulation exercises. All three training techniques would have distinct advantages and disadvantages depending upon the training time and resources available to a particular unit.

The characteristics of the infantry field opposition exercise were:

1. A battle lane approximately 1500 meters long and 125-250 meters wide was marked on actual terrain.
2. The exercise simulated a platoon (-) in the defense and a platoon in the attack. The attack force was represented by a platoon leader and three NCOs (squad leaders). The defending force consisted of a platoon leader and two NCOs (squad leaders). Each participant in the exercise represented a set number of soldiers: symbols affixed to each leader's helmet identified the number of soldiers that he represented. A three to one force ratio was established in favor of the attack platoon.
3. At the beginning of the exercise each platoon leader was issued a mission from which he was expected to develop an operations plan. He was required to communicate that operations plan to his subordinates and execute the plan against an opposition force.
4. Direct contact with the enemy was simulated by firing blank ammunition. Helmet symbols allowed players to recognize the size force with which contact had been made.
5. Three controllers monitored the action and assessed casualties according to infantry mapboard game rules. Losses were marked on a unit description card carried by each game participant to keep track of his unit's losses.
6. The firing of weapons (and occasional controller prompting) provided participants with information needed to permit them to react to developing situations and to interact with their platoon leaders.
7. Automatic M16 fire and claymore explosions were used to symbolize heavy weapons which could be associated with larger bodies of troops and troops in fortified positions.

8. Indirect fire was employed by using the REALTRAIN¹ technique of placing artillery simulators as requested by either side.
9. All fire missions were received and executed by the three-man control team (not a REALTRAIN technique).
10. Casualties were assessed using the casualty assessment table developed for the infantry mapboard game.
11. Defensive bunker positions were marked by stakes or flags. Contact at main enemy defenses was arbitrated as in the infantry mapboard game. The effect of indirect fire employed against these defenses was determined by the indirect fire casualty assessment table.

Pilot Test of Field Opposition Exercise. A pilot test of the field opposition exercise was conducted at Fort Knox, Kentucky in November 1974.

The main objectives of the pilot test were (1) to determine whether or not the exercise would work in the field and (2) to make an initial assessment of the training potential of the exercise.

The pilot test employed 14 personnel from the Training Battalion at Fort Knox over a three-day period. During the first day, the exercise was run through without Army personnel to make an initial determination of the workability of the exercise. Because the control function was found to be extremely difficult on the first day, it was decided that key observations concerning training value might be lost if Army personnel attempted the controller role at this early development stage. Therefore, on the second, and third days, exercises were conducted with Army personnel assuming participant roles and research personnel serving as the three controllers.

The pilot test produced the following observations concerning the workability and ultimate training value of the exercise:

1. The exercise was difficult to control for two major reasons. The controllers had many responsibilities to coordinate, including receiving and executing indirect fire missions, arbitrating all contact, and conducting a

¹REALTRAIN was the code name for the Army Research Institute project in which the engagement simulation training technique was developed. The code name was used for the technique applied to combined arms elements in TC 71-5.

comprehensive after-action review. In addition, controllers were occasionally required to prompt participants to initiate certain specific actions. For example, a controller might have to tell a participant to fire his M16 on automatic rather than single rounds, to indicate an ambush. Participants, although representing more than one individual, tended to fire single shots when confronting another individual. Controllers also had the difficult task of attempting to visualize the position of troops that were only symbolically represented on squad leaders' helmets. This task was especially difficult in attempting to assess the casualty effects of direct and indirect fire.

2. Platoon leaders tended to move their hypothetical squads more rapidly than would have been possible in actual combat. It is easier for three squad leaders to move rapidly than for a full complement of 40 men.
3. However, the test demonstrated that unit leaders derived a number of significant training benefits from participation, including (a) how to communicate an operational plan to subordinates; (b) how to coordinate movement among squads, especially in positioning elements to allow effective utilization of supporting artillery fire; (c) how to respond to enemy cues and to develop options to counter enemy actions; and (d) how to analyze terrain in a combat situation.

Documentation of Infantry Field Opposition Exercises. Revisions were not made in the field opposition exercise at the time of the test. The pilot test indicated that the major implementation problems associated with the training technique were going to be documenting the technique so Army personnel could effectively control a field opposition exercise. Consequently, the decision was made to document the exercise for user implementation and to conduct a pilot test of the documentation at Fort Benning, Georgia.

A manual was produced detailing the rules and procedures of the field opposition exercise to support its implementation by Army personnel without assistance.

DEVELOPMENT OF INFANTRY MODEL TRAINING SYSTEM

Test of Documentation of Two Mapboard Games and Field Opposition Exercise. Prior to integrating the training techniques into a model system, testing effectiveness of the various manuals was required.

A pilot test of the documentation developed to support user implementation of the two mapboard games and field opposition exercise was conducted at Fort Benning, Georgia, in April 1975. The purposes of this pilot test were (1) to determine if the games and the field opposition exercise could be properly executed by Army personnel without the direct assistance of the developers, and (2) to introduce the games and exercise to non-commissioned officers. Small unit combat often requires NCOs to assume leader responsibilities under fire. Therefore, NCOs were an appropriate additional training population for the games and the exercise. Exposing the training techniques to NCOs was expected to result in several benefits:

1. The games and exercise would provide NCOs with an excellent perspective on the nature of their responsibilities and behaviors in leader/group process relationships required for command and control.
2. The appropriateness and the usability of the three training techniques would be assessed with NCOs as well as junior officers.
3. The reactions and suggestions of NCOs who had been exposed to the games and the exercise would provide useful information for improving effectiveness of the techniques.

The pilot test was conducted with 15 NCOs from the 197th Infantry Brigade. The games and the exercise were introduced to player and controller personnel with an explanation of the purposes of the training techniques and the activities in which they would engage over the next several days. Players and controllers were provided game and exercise documentation. They were asked to review the documentation carefully and to be able to set up and play the games on the following day without the assistance of the research staff. NCO personnel played the infantry mapboard game first. If personnel successfully accomplished this task, the plan called for them to play the multi-person mapboard game. After they had completed the game, it was planned that Army personnel would independently set up and implement a field opposition exercise.

On the first day of the test it was found that controllers and players were able to successfully set up the infantry mapboard game

but that controllers experienced considerable difficulty in executing their responsibilities once game play actually began. The research staff therefore took over the job of controlling in order to allow the remainder of the plan to be carried out. Because of the difficulties encountered, it was decided to forego testing of user implementation of the multi-person mapboard game and to proceed directly to testing the field opposition exercise.

As with the mapboard games, player and controller personnel were asked to study the manual for the field opposition exercise carefully before attempting to implement the exercise without assistance. However, as Army personnel began to implement the exercise, it became immediately apparent that the tasks involved in execution of the exercise were beyond the capability of the Army personnel, given their limited amount of time to prepare.

Staff Observation. In reviewing the effectiveness of the mapboard game documentation, it was concluded that the manuals contained too much information for these personnel to absorb in a day's time. Clearly, ways had to be found to present the necessary information to Army personnel more efficiently and parsimoniously.

The documentation for the field opposition exercise was also believed to be too long for Army personnel to absorb in a short time. However, the staff felt that the difficulties experienced in executing the exercise were a function of problems other than documentation. Specifically, it was felt that the controller's function was far too demanding and called for the knowledge and use of the very information the game was designed to provide personnel (e.g., weapons effects, detection probabilities, etc.).

NCO Observations. In informal discussions following the exercises, NCOs made the following observations on the game and the field opposition exercise:

1. Both the game and the exercise provided NCOs with good insight on the demands placed on small unit leaders in combat situations.
2. Because of the frequency of casualties of leader personnel in combat, NCOs felt this insight would be invaluable in combat situations where they were forced to assume a role of more responsibility.
3. NCOs indicated that they had acquired a better perspective on the importance of their own roles in the leader/group process interaction essential to the success or failure of a combat operation.

4. NCOs felt that the games could best be implemented and executed through introduction by a cadre.
5. NCOs stated that the roles of the controllers in the field opposition exercise were far too demanding. They underlined the difficulty the controllers faced in assessing casualties on personnel who were not physically present in the exercise.
6. NCOs indicated that the field opposition exercise had several distinct training values. It provided them with excellent experience in map-to-ground association. It provided excellent practice in employment of indirect fire, especially in the coordination of this fire with the movement of maneuver elements. It provided realistic experience in leader/subordinate interaction in planning an execution of movement to contact on the attack and positioning of elements on the defense.

Further Revision of Mapboard Games. After the pilot test of the documentation for user implementation of the mapboard games at Fort Benning, Georgia, the documentation was revised to provide all essential game information to players and controllers in the form of job aids on the mapboard surface. The manual provided only rules and procedures for play.

The following two specific design revisions were made:

1. All tables originally included in the infantry mapboard manuals were printed on the mapboard surface. These tables included infantry rate of movement, detection distances, weapons characteristics and effective ranges, symbols for organization and equipment, indirect fire casualty assessment procedures, and a form for recording casualties sustained.
2. Player and controller aids were designed to maintain records of artillery requests, appropriate splash times, and ammunition expenditures.

Testing of Revised Mapboard Game Documentation to Support User Implementation. Revisions in the mapboard game documentation were tested in May with six NCOs and six junior officers from the 82nd Airborne Division at Fort Bragg, North Carolina. As in the earlier pilot test at Fort Benning, the game was introduced to Army personnel with an explanation of its purposes and the nature of the activities in which they would participate over the next several days. Players and controllers were asked to study the revised documentation carefully. The time allowed for this review was the same as in the Fort Benning test. After they studied the manual, players and controllers were instructed to set up and play the games without research staff assistance.

During this pilot test, the following observations were made:

1. Players and controllers were able to set up game play without research staff help.
2. Fort Bragg personnel (both players and controllers) were able to play the game with markedly greater ease than Fort Benning personnel had played in the earlier test. It appeared that this improvement could largely be accounted for in the ready accessibility of critical information (job aids) on the game board surface.
3. Some variability among controllers was noted in judgments concerning the number of personnel visible to a defender and number of personnel who might be in a kill zone. However, it appeared that this variability in judgment had little overall effect on the outcomes of the games or their value as training techniques. (As with SCOPES¹ and REALTRAIN, the correlation of casualties produced in the simulation and on a rifle range is far from perfect, but "good enough" for believability.)
4. The only aspect of the games that were ineffectively implemented by Army personnel were the after-action

¹ SCOPES is an acronym for Squad Combat Operations Exercise (Simulation) coined at The Infantry School for use in TRADOC TC 7-2 (Test). SCOPES refers to an Infantry application and REALTRAIN to an armor/anti-armor application. The basic two-sided, free play training method, with casualties assessed in close to real time is common to SCOPES and REALTRAIN as well as to other applications.

reviews.¹ Controllers did not appear to be able to reconstruct the battles for players so that critical mistakes could be identified and positive actions reinforced. Since it was believed that a great deal of the learning value of the games derived from the after-action reviews, game documentation needed to be made more detailed and explicit on how to conduct an after-action review.

Revision and field testing of documentation for the field opposition exercise had been planned, but an opportunity arose to test the overall effectiveness of all three training techniques combined in a large-scale field research effort using troops of the Berlin Brigade, Berlin, West Germany. Therefore, a model training system combining the techniques was constructed in May 1975.

Field Test of Model Training System. Only the effectiveness of the two-person mapboard game had been tested with respect to the actual simulated combat performance of small unit leaders (Fort Lewis, August 1974). The multi-person mapboard game and the field opposition exercise were designed to supplement the individual mapboard game, and the combined effect of these three training techniques on small unit leader combat performance needed to be investigated.

A full-scale field test in Berlin with two rifle companies was planned for June 1975. The test was designed to assess the three training techniques with the following two research objectives:

1. To determine if infantry units could implement the two mapboard games from written documentation without assistance. (It was recognized that this would not be possible with the field opposition exercise since no revision of the documentation or mechanics of the exercise had been made.)

¹

The after-action review is an important aspect of the engagement simulation training method. Immediately following the simulated battle all participants gather and recount the individual events as they occurred. Casualties hear from their opponents how they became casualties. A leader typically comments on how the actions taken by each side led to overall outcomes and how other actions might have resulted in different outcomes. The hypotheses about alternative actions are tried out in subsequent exercises. Thus learning in this method occurs in the AAR as well as in the engagement. Repeated trials with feedback and interpretation in the AAR enable individuals and units to develop effective combat skills.

2. To determine if units led by leaders trained on the three techniques could perform more effectively in simulated combat situations than units led by leaders without this training.

The research team was composed of personnel from ARI, Kinton, Incorporated and the Infantry School.

Design. The experimental design for the field test called for four weeks of preparation in the training model for Alpha Company, the "experimental" rifle company. During the first week of this four-week period, the "control" company, Bravo Company, was trained to conduct engagement simulation exercises. For the remaining three weeks, Bravo Company's preparation was left to the discretion of its company commander, who decided to train his troops using engagement simulation exercises. In the fifth week, six engagement simulation exercises were conducted between the two companies. The principal outcome variable for the test was the number of battles won by Alpha Company.

The experiment lasted five weeks. During the first four weeks, the two companies received the following preparation.

	<u>Alpha Company (Experimental)</u>	<u>Bravo Company (Control)</u>	<u>Test Controllers</u>
Week 1	Key leaders and subordinate leaders played individual and multi-person mapboard games.	Controller personnel were selected and trained to run engagement simulation exercises. Leaders and troops were introduced to engagement simulation exercises.	Selected from companies and taught control procedures for engagement simulation.
Week 2	Unit leaders and subordinate leaders participated in field opposition exercises. Alpha Company troops were introduced to engagement simulation techniques.	Some elements of the company received engagement simulation training.	Exposed to all aspects of engagement simulation exercises (to include indirect fire control procedures).

	<u>Alpha Company (Experimental)</u>	<u>Bravo Company (Control)</u>	<u>Test Controllers</u>
Week 3	Unit leaders and subordinate leaders interacted with troops in engagement simulation exercises.	Full-scale engagement simulation exercises.	Controller group controls full-scale engagement simulation exercises.
Week 4	(Same as Week 3)	(Same as Week 3)	(Same as Week 3)

Since a major purpose of the field test was to determine the extent to which Alpha Company could effectively play the two mapboard games, the design called for careful observation of mapboard game activity during the first week of the five-week period. Mapboard game activity was introduced and monitored in a way that would allow Alpha Company personnel maximum flexibility and independence in game play. It was felt that this independence and flexibility would help identify the most critical problems still needing solution in the documentation for the game.

This same attitude was applied to the small unit leader field exercise even though its development was not as advanced as the mapboard games. By allowing Army personnel as much independence as possible, the staff could have another look at problem areas identified in earlier pilot tests.

The test exercises were conducted during the fifth and final week of the test. Alpha Company was on the attack for three battles and on the defense for three battles. In the first battle, Alpha Company attacked with three to one odds. In the next two battles, they attacked with two to one and one to one odds, respectively. In the fourth battle they defended against three to one odds. In the last two battles they defended against four to one and five to one odds, respectively.

Odds in favor of the control company were gradually increased to provide a quantitative measure of the potential effectiveness of the combined training techniques. Alpha Company was scheduled to run three attack exercises followed by three defense exercises rather than to alternate between attack and defense. If Bravo Company had been permitted to defend and then attack during the first two battles of the test exercise, their experience would probably have increased their sophistication with respect to both defense and attack strategies and techniques.

Findings. Table I shows the results of the six battles conducted during the fifth week of the field test compared with the results of the Fort Lewis field experiment described earlier. The comparison reveals several interesting facts:

1. In both field tests the experimental units won a large majority of the battles.
2. There is a marked difference between the Fort Lewis and Berlin tests with respect to the outcomes of battles in which the experimental units were on the attack. At Fort Lewis the experimental unit won only three out of five of the attack battles and suffered casualties at an average of approximately 84.6%. In Berlin the experimental unit won all three attack battles with an average casualty rate of approximately 46%. This difference is especially interesting in light of the odds against the experimental unit in Berlin, which were much greater than those against the experimental unit at Fort Lewis.

An analysis was performed of the Berlin battle narratives to identify effective and ineffective behaviors on the part of unit leaders for the planning and execution phases of a sample of the battles. The analysis revealed that most ineffective behaviors demonstrated by experimental leaders occurred in situations where units were involved in heavy contact. A comparison of behaviors exhibited at Fort Lewis and Berlin revealed a marked increase in the effective behaviors demonstrated by experimental unit leaders in the execution phases of attack operations (see the Appendix). A good example of this improvement in attack execution behaviors is seen in a comparison of Battle 5 at Fort Lewis and Battle 1 in Berlin. In Fort Lewis the attack platoon leader failed to interpret the discovery of an enemy OP as an indication of the proximity of the main bunker positions. Consequently, the leader moved his platoon forward and became decisively engaged prior to determining the exact disposition of the bunker complex. However, in Berlin, the platoon leader used discovery of an OP position to accurately pinpoint the disposition of the bunker complex and was able to employ effective indirect fire to neutralize most of the complex.

Alpha Company personnel were able to organize and play both map-board games with only minimal assistance. Research personnel agreed, however, that the after-action reviews for both games were unsatisfactory. It was felt that the inadequate performance of the after-action reviews was more a function of the limited amount of time

TABLE I
PERFORMANCE OF UNITS
LED BY EXPERIMENTAL OFFICERS
IN THE ATTACK

FORT LEWIS FIELD TEST

<u>Battle</u>	<u>Outcome</u>	<u>Ratio-Attack & Defense</u>	<u>% Casualties Sustained Attack</u>
1	Win	3:1	70
3	Win	3:1	80
5	Loss	3:1	98
7	Win	3:1	85
9	Loss	3:1	90
3 Wins 2 Losses		Average % 84.6	

BERLIN FIELD TEST

<u>Battle</u>	<u>Outcome</u>	<u>Ratio-Attack & Defense</u>	<u>% Casualties Sustained Attack</u>
1	Win	3:1	30
2	Win	2:1	40
3	Win	1:1	50
8*	Win	1:1	62
4 Wins 0 Losses		Average % 46	

*Conducted as a follow-on battle after actual field test had been completed.

permitted for the reviews than it was a lack of ability on the part of Alpha Company personnel to conduct effective reviews.

Alpha Company personnel conducted the field opposition exercise with careful monitoring and corrective intervention on the part of research personnel. Although no attempt was made to have Alpha Company run the exercise fully independently, corrective intervention was limited to preventing occurrences that would result in a complete breakdown of the exercise.

Observations and Tentative Conclusions. On the basis of a comprehensive review of all activities and results from the five-week test period, the following observations and tentative conclusions were made about the effectiveness of the three training techniques and the extent to which they could be effectively implemented by infantry companies:

1. Although there were distinct differences between the designs for the Fort Lewis and Berlin field tests, a comparison of the results of the two tests provides some evidence that the combination of the two mapboard games with the field opposition exercise provided more effective training support than did the individual mapboard game alone.
2. The Berlin field test provided no data on the individual effectiveness of any of the three training techniques. It was felt that these kinds of questions required further research.
3. With the exception of conducting the after-action review, Alpha Company personnel successfully executed both mapboard games without assistance. Given the importance of the after-action review in supporting learning, allowing unit personnel sufficient time for conducting this phase of the games would enhance the effectiveness of the techniques.

Final Revision of Infantry Mapboard Games. A limited amount of time during the fall of 1975 was devoted to making several minor modifications in the mechanics of the two games.

1. Arbitration as a means of determining final outcome was replaced by a weapons effects hit probability table for determining outcome in heavy contact.

2. Minor improvements were made in the weapons effects table to provide rules for simultaneous contact and ambushes.
3. New plastic playing pieces with stick-on symbols replaced the colored nuts and spikes.
4. One concise manual was prepared to present the rules and procedures for both games.

Final Test of Infantry Mapboard Games. A final test of the two mapboard games was arranged for nine soldiers (two 2d Lieutenants and seven enlisted personnel with the rank of Sergeant E5) from the Second Brigade, 82nd Airborne Division, Fort Bragg, North Carolina, in March 1976. The purpose of this test was to identify any further changes required in the game's documentation prior to submission of the games for approval.

The test was conducted over a three-day period in which Army personnel participated in game play, alternating between attack, defense, and control roles. The games were introduced to Army personnel by the research staff, who initially functioned in the primary control roles. Army personnel soon took over the control functions. After each of the nine soldiers had played approximately six games, informal discussions were held to elicit the soldier's reactions to the game, especially the game mechanics.

It was evident from observations of the nine soldiers during game play and from their comments during the informal discussion periods that inexperienced controllers and game participants could play the games with only minor errors. To correct the remaining deficiencies, the following changes in game mechanics and documentation were proposed:

1. Different colored plastic cue pieces, rather than (radio) voice communication, should be used as a method for controller to provide appropriate cues to players.
2. Indirect fire overlays should be consolidated on one overlay.
3. An overlay should be developed for claymore and other anti-personnel mines.
4. Map grid squares should be subdivided to allow for better control of the movement of playing pieces.

5. Suppression of personnel, as well as casualties, should be considered in assessing artillery fire effects.
6. A more expedient method for determining number of casualties from indirect fire should be considered.
7. Playing pieces representing fire teams should be replaced by pieces representing one soldier with equipment. Fire team pieces create confusion as to how many personnel are actually in the kill zone and what equipment is lost.

All of the proposed changes in the games, with the exception of the map grid squares, were incorporated into game mechanics and related documentation. Final documentation for the two-person map-board game is presented as a separate document.

Developmental Tests of Infantry Field Operation Exercise. During the fall of 1975 and early winter of 1976, two field opposition exercises were conducted with National Guard personnel at Fort Meade, Maryland, to gather data for needed redesign of the exercise to include the following:

1. Reducing the difficulty of the control function.
2. Modifying exercise mechanics to minimize the requirement for participating personnel to make abstract decisions and to reduce unrealistically rapid movement by participants.
3. Expanding the content of the field opposition exercise to provide for more skill-building in areas related to contact situations. (The Berlin test showed that most ineffective behaviors demonstrated by experimental leaders occurred in situations where units were involved in heavy contact.)

Results of these two field opposition exercises suggested the following revisions to the exercise were required:

1. More controllers were necessary for proper conduct of the exercise. Consideration was given to a new controller configuration in which two direct fire controllers (attack and defense) would be supported by two indirect fire controllers.

2. The field opposition was originally designed so that mapboard game rules could be used to control assessment of contact. However, these rules appeared to be inadequate in the actual running of the field opposition exercise due to the length of time required to make assessments and to the lack of inter-controller reliability.

A SCOPES casualty assessment procedure¹ was suggested as a possible improvement. It was felt that use of such an assessment procedure would reduce the amount of unrealistic movement by player participants and would greatly simplify the controller's role in assessing casualties. The procedure would require participants to obtain an opponent's number in order to score a kill. It was felt that this was a much easier task for a controller than making all casualty assessments based on interpretation of positions and weapons involved in the contact between two elements.

A revised version of the field opposition exercise was developed and documented in the early spring of 1976. (For easy reference, the original version will be called Field Opposition Exercise I, and the revised version will be called Field Opposition Exercise II.)

Comparison of Field Opposition Exercise I and Field Opposition Exercise II. A comparative evaluation of Field Opposition Exercise I and Field Opposition Exercise II was conducted at Fort Bragg, North Carolina in March of 1976. The purposes of the comparison were to (1) obtain the reactions of Army personnel participating in both exercises as to the ease of control and overall training benefits of both exercises and (2) to observe both exercises so that opinions about their relative training effectiveness could be formed.

¹This procedure was designed to allow each exercise participant to represent a number of soldiers. The participant would be assigned as many helmet covers as soldiers he was to represent. For example, assume that a participant was to represent five soldiers. He might be assigned five helmet covers numbered 05, 20, 32, 64 and 41. Assume that he began the exercise wearing 05. If he were assessed a casualty in a SCOPES engagement, he would drop back approximately 30 meters, change his helmet cover to one of the four other numbers, and proceed forward. This procedure would be repeated each time the participant was assessed a casualty.

The comparative evaluation was supported by 15 Army personnel (in grades of E-5 and E-6) from the Second Brigade of the 82nd Airborne Division (including nine personnel used in the final test of user implementation of the two mapboard games). The test lasted three days. On the first day, the purpose of the evaluation and the concepts and mechanics of the exercise were explained. Two iterations of the field opposition exercise were run on the second day. Personnel were rotated through the defense, attack, and control roles. During the third day, the same procedure was followed for Opposition Exercise II. The exercises were closely monitored but research personnel made suggestions to exercise participants only when it appeared that completion of the exercise was in jeopardy. An informal debriefing was conducted at the conclusion of the exercises to obtain from all Army participants specific comments on the strengths and weakness of both exercises, and on their relative effectiveness. The following is a summary of those comments:

1. Field Opposition Exercise II was not as difficult to control, primarily because of the SCOPES casualty assessment procedure.
2. Field Opposition Exercise II was more realistic for participants because it required them to obtain an opponent's number in order to score a kill. In Field Opposition Exercise I a controller made all casualty assessments based on his interpretation of the positions and weapons involved in the contact between two elements.
3. Field Opposition Exercise I could only be implemented by Army personnel if the exercise concepts were taught by a cadre.

Research personnel drew the following conclusions from the evaluations:

1. Consistent with the reactions of the Army personnel, Field Opposition Exercise II appeared easier to control than did Field Opposition Exercise I.
2. Unrealistic movement (one man representing a squad could move faster than an actual squad) did not appear to be a problem in Field Opposition Exercise II.
3. Field Opposition Exercise II appeared to be a substantial improvement over Field Opposition Exercise I in terms of decreasing the amount of tactical abstraction and eliminating unrealistic movement.

4. However, it still did not appear to solve the control problem nor to be in a form which could be implemented as a training technique without a cadre. Also, the lack of realism in direct fire contact made questionable the degree of training benefits received by small unit leaders in situations where this type of contact occurred. This type of exercise did not realistically expose a leader to the difficulty and confusion he would experience in attempting to control and obtain information from a group of men in contact situations.

As a result of the developmental test research personnel concluded that substantial work was still required to solve these major problems.

Development of Field Opposition Exercise III. Field Opposition Exercise III differed from Field Opposition Exercise II in both design and control of the exercise. Field Opposition Exercise III was designed as a reduced scale SCOPES exercise in which the number of personnel, amount of equipment, and area covered would be reduced without concomitant reduction in the fidelity and realism of the exercise. The additional troop support needed to conduct a reduced SCOPES exercise would be obtained by designing Field Opposition Exercise III as a company training technique for three platoon teams. A team would consist of a platoon leader and three squad leaders. This team organization would remain intact when the team functioned in a defense or control role. However, when assigned an attack role the team would be augmented by eight enlisted troops. These support troops would rotate among the three platoon teams in order to provide a three to one ratio in favor of the attack force. One additional support soldier would be used to operate the Net Control Station. The platoon assigned the control role would be supported by a five-man control team: three soldiers would operate the fire direction center and the other two would act as artillery throwers. At the fire direction center two soldiers would receive and compute fire missions and the third soldier would direct the fire markers into position. The company commander or the executive officer would act as chief controller.

It was hoped that the introduction of a team to operate both as participants and controllers, plus the realism of the exercise, would solve the nagging control problem found in the other two versions of the field opposition exercise.

Pilot Test of Field Opposition Exercise III and Comparison with Versions I and II. Two pilot tests of the Field Opposition Exercise III (Fort Stewart, Georgia, and Quantico, Virginia) were conducted in August 1976 following completion of the development of

the exercise. In each of these pilot tests, Field Opposition Exercises I and II were also run to provide comparative information and to maximize the number of possible insights and hypotheses which could be generated from such a test. The specific objectives of both tests were (1) to obtain the reactions of Army personnel participants with respect to the relative training effectiveness of each of the three exercises, and (2) to provide an opportunity to observe the effectiveness of Exercise III.

In both pilot tests, the different types of small unit leader field opposition exercises were introduced as they had been at Fort Bragg. At the end of training, informal debriefings were held to obtain the reactions of participating Army personnel to the perceived training effectiveness of the three exercises. The following is a summary of the obtained reactions:

1. Field Opposition Exercise III was the most realistic of the three exercises. Participants strongly implied that Field Opposition Exercise III provided the most training benefits of the three because of its realism.
2. The absence of the requirement for making abstract decisions in the Field Opposition Exercise III made control and execution relatively easy.
3. Field Opposition Exercise I was difficult to control because of the great number of abstract decisions required, but it was a good preparatory exercise for Exercise III, as it provided an excellent opportunity to practice employment of indirect fire, especially in conjunction with maneuver of platoon elements.

Results of the pilot test prompted the following conclusions:

1. Field Opposition Exercise I was felt to be beneficial as it introduced small unit leaders to certain basic skills and group interaction processes needed to participate effectively in Field Opposition Exercise III. For example, by reducing fidelity of direct fire effects, such skills as utilization of indirect fire, coordinating indirect fire with maneuver elements of the platoon, an analysis of enemy intentions could be focused on by the small unit leader.
2. Although the difficulty of control in Field Opposition Exercise I still remained, if direct fire were also used only to provide appropriate cues, the exercise could be an effective basic introduction to leader skills and group interaction processes.

3. Field Opposition Exercise II, while not as easy to conduct as Exercise III, had value as a possible substitute where resources (e.g., personnel, ammunition) or time constraints prohibited use of Field Opposition Exercise III.
4. Field Opposition Exercise III appeared to be the most realistic and pedagogically sound of the three exercises.
5. Although Field Opposition Exercise III posed potential problems in terms of requirements for an increased number of personnel and amount of equipment, the potential problems did not appear to outweigh the increased training benefits.
6. Control problems were minimal in Exercise III. The realism and small scale of the exercise appeared to be one factor in easing control difficulties. Another factor was the use of the platoon team in both player and controller roles. By interacting as a team in both assignments, participants seemed to acquire a better understanding of the importance of the control function. Also, the ability of the individuals to work together as an effective control group was increased.

The three training techniques were documented to incorporate the observations gained from the comparative tests. The three versions of the field opposition exercise are documented in a separate report.

Development of Revised Field Opposition Exercise III. Although these pilot tests were the intended final research efforts for this aspect of the program, further analysis of Exercise III several months later caused research staffs to hypothesize that Exercise III would better address command and control problems inherent in ground combat actions if fire team leaders were included as part of the leader cadre. In actual combat and in engagement simulation exercises there is an interaction process between squad leader and fire team leaders which precedes the interaction process between squad leader and platoon leader. The absence of this second level of interaction in Field Opposition Exercise III resulted in inadequate exposure of leaders to command and control problems inherent in the direct fire contact situation. In heavy contact, a great deal of information must be interpreted, processed, and communicated between leaders before effective action can be taken. Also, considerable interaction must occur between leaders and subordinates to communicate and execute plans effectively. In Field Opposition Exercise III, the squad leader received action cues at the point of enemy contact from a non-leader participant and then communicated these cues to a platoon leader. The

platoon leader then communicated to the squad leader a plan which required no further action at subordinate leader level. This procedure neglected an entire interaction process that would occur in actual combat, i.e., the interaction process between the squad leader and the fire team leader.

Therefore, it was decided to modify Field Opposition Exercise III to include fire team leaders as participants in the exercise and to test the modified exercise at Fort Stewart, Georgia.

In the revised Field Opposition Exercise III a team consisted of 12 members: a platoon leader, a platoon sergeant, three squad leaders, six fire team leaders and an RTO. The platoon team constituted an attack force and opposed a reduced team (platoon sergeant, one squad leader, and two fire team leaders) from another platoon. A control group from the third platoon team accomplished the control function. Platoon teams rotated through control, attack, and defense roles so each team assumed each role at least once.

A change was made in controller training. In the past, controller training had consisted of a one-day briefing and familiarization. Controller training was extended to two days before conducting tactical exercises. The control training centered on training leaders to control SCOPES exercises, so that they could serve as controller for their full units. Control of Field Opposition Exercise III was similar.

Pilot Test of Revised Field Opposition Exercise III. A three-day pilot test of the revised Field Opposition Exercise III was conducted at Fort Stewart, Georgia in August 1977. The first and second days were devoted to training the platoon teams and indirect fire control teams in setting up and controlling a SCOPES exercise. A field opposition exercise was conducted on the third day. At the end of this test period, debriefings were held to obtain reactions of Army participants to the exercise. The following is a summary of the conclusions reached:

1. Field Opposition Exercise III (Revised) provided an excellent opportunity for leaders and subordinate leaders to practice leader/subordinate interaction without the presence of troops and the corollary pressures of maintaining authority, images, and so on.
2. Control of the exercise was not difficult. The two-day preparatory training prepared the teams for the control function very well.

3. Training all the teams to execute the control function facilitated consistency in controlling and proper conduct of the exercise and subsequent SCOPES exercises.

DEVELOPMENT OF COMBINED ARMS MAPBOARD GAME

Current Army doctrine emphasizes the importance of the integration of mechanized infantry, armor, and anti-armor elements in conducting successful tactical operations against a deployed enemy. A combined arms mapboard game that would provide junior officers with the opportunity to become familiar with the nature of these combined arms operations would be a desirable training technique.

In the fall of 1975, a combined arms mapboard game was designed and developed based on the mechanics of both infantry mapboard games with the following modifications.

1. Each playing surface represented an area 10,000 meters in length and 3,000 meters in width. Playing surfaces were suspended on rollers which could be laid on tables. An area 3,000 meters by 3,000 meters was exposed for each player. The remainder of each playing surface was rolled under the table top.
2. Two alternative types of playing surfaces were developed. One type provided a two-dimensional surface with color coding to indicate differences in elevation. The other was a three-dimensional rubberized surface in which differences in elevation were represented by contoured mounds on the surface. (Since the game would involve so many long range engagements, it was critical that controllers be able to determine accurately if line of sight between weapon and target existed. It was felt that the assessment of two game surfaces would better insure finding an accurate means for controllers to make the line of sight determination.)
3. Playing pieces were devised to adhere to the rubberized surface.
4. Playing pieces were developed to represent the TO&Es of combined arms task force elements.
5. Movement and detection tables were developed incorporating movement of mechanized and armored vehicles.
6. The weapons effects table incorporated casualty and detection probability for anti-armor weapons, e.g., Dragon, TOW, anti-tank mines.

7. A smoke screen guidance chart and guidelines for using scatterable mines were developed.
8. The indirect fire casualty assessment table included effects on mechanized and armored vehicles.
9. Two controllers, rather than one, were employed because of the increase in the number of simulated elements.

Potential training benefits for small unit leaders of the combined arms mapboard game were:

1. They would become familiar with the overall nature of combined arms operations.
2. Their planning skills in combined arms operations would be increased, especially skills in coordinating combined arms task force elements in simulated battle operations.
3. They would experience the extreme accuracy of modern weapons, and would gain extensive experience in counter-ing the effects of enemy employment of similar destructive weapons.
4. They would gain experience in coordinating supporting artillery with combined arms elements.
5. They would have an opportunity to learn refined aspects of terrain analysis taking into account the great distances on which combined arms operations are performed.
6. They would get practice in contingency planning during the rapid development of situations which often occur in combined arms operations.

The complexity of the combined arms mapboard game could be expected to pose certain difficulties to controllers. However, it was felt that inexperienced controllers could perform adequately if control responsibilities were divided between two persons--one for arbitration and cues, and the other for executing and assessing indirect fire missions.

Following initial design and development of the combined arms mapboard game, a pilot test of the game with junior officers was planned.

Pilot Test of Combined Arms Mapboard Game. In January 1976, six Lieutenants from the Third U. S. Infantry Regiment at Fort

Myer, Arlington, Virginia, participated in a pilot test of the combined arms mapboard games. The objectives of the test were to obtain player reactions to, and gather observations on:

1. The realism of the two playing surfaces.
2. The adequacy of controller and player aids and game mechanics.
3. The accuracy with which TO&E of elements of combined arms task forces were represented in game play.
4. The clarity and ease of understanding of the controller/player handbook.

At the beginning of the two and a half day test period, the game was explained to the six Lieutenants, who were then assigned to player and controller roles. The research staff assisted the Lieutenants in play and control of an orientation game. The Lieutenants were then given the game documentation and asked to switch roles for the next day so that no one participated in the same role twice. Each Lieutenant played two games, one on the two-dimensional surface and one on the three-dimensional surface. At the end of each day, and again at the end of the test period, informal discussions were held with the Lieutenants to obtain their reactions to the game.

The Lieutenants' reactions to the game were very favorable. Specific comments included:

1. The game developed an appreciation for the effectiveness of modern weapons and sophisticated options needed to counter them.
2. The game provided an opportunity for the development of skills in terrain analysis.
3. The game provided experience in the development of operational plans for the conduct of combined arms operations.
4. The game provided an opportunity for the development of skills needed to coordinate various elements of the combined arms team, especially the positioning of missiles and other long range weapons.

The game was ready for a more rigorous pilot test by officers (both junior and senior) more experienced in combined arms operations. Documentation for the combined arms mapboard game is being published separately.

DEVELOPMENT OF COMBINED ARMS FIELD OPPOSITION EXERCISE

In the fall of 1977, a combined arms field opposition exercise was developed to provide senior (company team) and junior (platoon, fire team, and section) leaders a training exercise in which leaders could interact in the planning and execution of combined arms operations without troop involvement.

The potential training benefits inherent in a combined arms field opposition exercise would be:

1. Practice in solving problems associated with command and control of combined arms operations.
2. Developing skills in employment of supporting artillery in coordination with maneuver elements.
3. Learning accuracy of modern weapons, e.g., TOW, Dragon.
4. Developing techniques to counter effectiveness of modern weapons that could be employed against a combined arms task force.
5. Developing sophisticated skills in terrain analysis.
6. Developing skills in quick, decisive contingency planning necessitated by the rapid movement inherent in armor and mechanized infantry operations.

The characteristics of the field opposition exercise included:

1. A battle area 1,500 meters wide and 3,000 meters long.
2. An exercise scenario of a combined arms task force moving to secure a designated objective against an opposition force (OPFOR). The OPFOR is given a set number of locations to engage from and withdraw to (e.g., engage at Phaseline Red /coordinates/ and withdraw to /coordinates/ to conduct delaying mission).
3. An OPFOR configuration to include a tank with a crew, a TOW, APC mounted with crew, and a three-man Dragon team.
4. A task force configuration to include a task force commander with 1/4-ton jeep, two tanks with the tank platoon leader, platoon sergeant and two tank commanders comprising one half of the crew for each tank; a TOW APC mounted with full crew to include TOW section leader, an infantry platoon leader, squad leader, and two fire team leaders with an APC M113A1.

5. Engagement simulation of the exercise limited to indirect fire and direct fire for major weapons systems (M60A1 or A2 Main Gun, TOW, and Dragon /90mm RR if Dragon is not available/).
6. REALTRAIN rules to be used to execute weapons simulation.

The development of the Combined Arms Field Opposition Exercise, currently ready for pilot testing, brought to a close work on these low cost training techniques designed to increase the proficiency of officers and NCOs in tactical training exercises (engagement simulation).

Although the emphasis of this study was on development and not summative evaluation, enough testing was done to demonstrate that such training techniques can enhance leader proficiency in tactical exercises.

The best combination of techniques or the degree to which this leader proficiency can be increased are questions which still have to be answered. Some of the techniques developed in this research effort are ready for summative evaluation. Others still need to complete the formative evaluation stage. The value of these techniques to the Army can only be determined by proceeding with a summative evaluation.

SUMMARY

This research is unusual in its duration and the number of training techniques actually conceptualized and developed. The development effort spans almost four years and addresses five training techniques and possible combinations of these techniques as models of training systems.

The development of these techniques and model training systems was accomplished in an interrelated "developmental sequence." This sequence consists of nine steps:

1. needs analysis
2. design stage
3. developmental stage
4. pilot test stage
5. revision stage
6. field test stage
7. revision stage
8. installation stage
9. final evaluation stage

The two-person mapboard game for infantry is at the installation stage of the developmental sequence.

Installation is defined (Popham, 1975) as the stage at which the product is introduced, on a limited basis, in the intended environment. Actual installation would be accomplished by the user, in this case Army infantry units, who possibly will deviate from the techniques originally specified by the developer. Evaluation of the training effectiveness of the installed game should be made by some agency other than the developer.

The multi-person mapboard game, as an independent training technique is also at the installation stage.

Small unit leader Field Opposition Exercise I is at the revision stage (post field test). Developers are considering it as an introductory training technique in an infantry small unit leader field opposition exercise training system. If this exercise is to be used as an introductory technique certain revisions, such as reducing direct fire to provide cues only, have to be made.

This need for minor revision in Field Opposition Exercise I caused research staff to place the exercise at the revision stage (post field test).

Small unit leader Field Opposition Exercise II is ready for summative evaluation. This exercise has gone through both pilot test and field test stages in formative evaluation. The research staff feels that this version of the field opposition exercise has two possible benefits.

1. As a substitute exercise for opposition Exercise III (revised) when resources prohibit conduct of this exercise.
2. As a second stage in a leader's progression to training in Field Exercise III (revised). The hypothesis is that the limited exposure to direct fire situations may better prepare a junior leader for the intense exposure to direct fire found in Exercise III (revised).

The small unit leader Field Opposition Exercise III (as revised in August 1977) is now at field test stage. The major revisions made in the concept of field opposition Exercise III necessitated the research staff to consider the initial test of the revised exercise a pilot test rather than a field test of the original exercise.

Also the research staff was still directly involved in the conduct of this test and the revised field opposition Exercise III has not yet been exposed to a rigorous user evaluation without direct research staff involvement.

In the spring of 1975, the two-person and multi-person games were combined with the small unit leader field opposition exercise as a model training system and the system was pilot tested in Berlin in May and June of 1975. This system is currently at a revision stage (post pilot test).

The pilot test indicated that a combination of the training techniques was potentially more effective than the individual game as a separate training entity, but certain problems were identified regarding the field opposition training technique.

Questions such as the exact design of the training system and specific contributions of each technique to the training product can only be answered at the advanced stages of the developmental sequence.

The uncertainty as to which combination of training techniques is the most effective led the research staff to develop a small unit leader field opposition training system, independent of the mapboard games.

The infantry small unit leader field opposition exercise training system is now at a revision stage (post pilot test). The conceptual design of this model is to use Exercises I and II as a progressive introduction to basic leader skills and leader/group interaction processes which, once learned, potentially will help small unit leaders to grasp the more complex skills and interaction processes inherent in Field Opposition Exercise III. The hypothesis is that a leader who can perform well in Exercise III should do well in full-scale engagement simulation exercises because pilot test data indicate that this is the case.

The combined arms mapboard game is at a field test stage. The product is well defined, but needs a more rigorous test of its practicality.

The initial design has been completed on the combined arms field opposition exercise, and it is ready for the development stage.

A graph reflecting the types of training techniques and training models and their progression in the development sequence is presented in Figure 1.

The objective of the research summarized here was to develop a low cost training medium for exercising junior officers and senior NCOs in tactical operations of small units. The training medium developed reduced requirements for personnel, materials, and training area as it addresses many skills which previously could only be taught in full-scale field exercises. The use of mapboard games followed by a field exercise without troops was anticipated. The initial emphasis was on infantry units, but use of artillery (and mortar) was considered an integral part of the infantry leader's tactical planning and execution. In later stages, the use of armor in combined arms teams was introduced.

Throughout the research and development effort the intent was to require the participants to exercise as many skills as possible in the training situation. As a consequence the mapboard games require leaders to plan, execute, continuously sense the threat capability, and develop alternative actions to counter the intelligent threat of the other side. The game situation does not include control of subordinate personnel, except when multiple players are used on each side.

The primary differences between the skill demands of the mapboard games and field exercises, and the demands of traditional classroom training and exercises are two:

1. The mapboard games present a two-sided situation with intelligent participants on both sides to pose a threat and to take advantage of every weakness.
2. They supply the motivation and context of a situation in which many skills must be exercised together and options traded off. This allows the learning of quick decision making and practicing of many items that are isolated from context during traditional training.

Many officers who participated in the game situation recognized that the operations they developed to counter an intelligent opponent were unlike the examples they had learned in traditional training. For instance, they found that they could accomplish many goals with indirect fire¹ that they had thought had to be accomplished with direct fire.

Perhaps the more sophisticated view is that participants learned a larger number of options available to them. The traditional training has tended toward the philosophy that a junior leader needs to know a set of pattern of actions to take, e.g., where to emplace his unit, how to conduct an attack, etc. To counter an intelligent opponent who also knows this repertoire of operations requires more unexpected options planned and available for use. Participants developed a greater variety of such options and skill in sensing what options opponents were using against them.

Whether or not these options would work in combat in exactly the same way they did in the game situation is an open question. The potential of the field opposition exercises are apparent but more research is needed in their development.

Most personnel participating in the game situations believed that their performance in the games was an accurate predictor of how they would perform in a similar combat situation. A small minority of participants felt that the game situation was only a mapboard exercise and that they would perform in combat in ways that were unrelated to their performance in the game. It is known that the skills learned from the games worked in similar ways in the engagement

¹This left a question in many participants' minds as to whether artillery could actually accomplish these goals in combat or whether they would have to bring direct fire to bear on the opponent. The indirect fire effects used in the games were based on guidance from the Artillery School, and it is known that artillery has accounted for most of the casualties in wars during this century. But there is still a question of whether indirect fire would be delivered in combat with the same assurance of effects incorporated in the game situation.

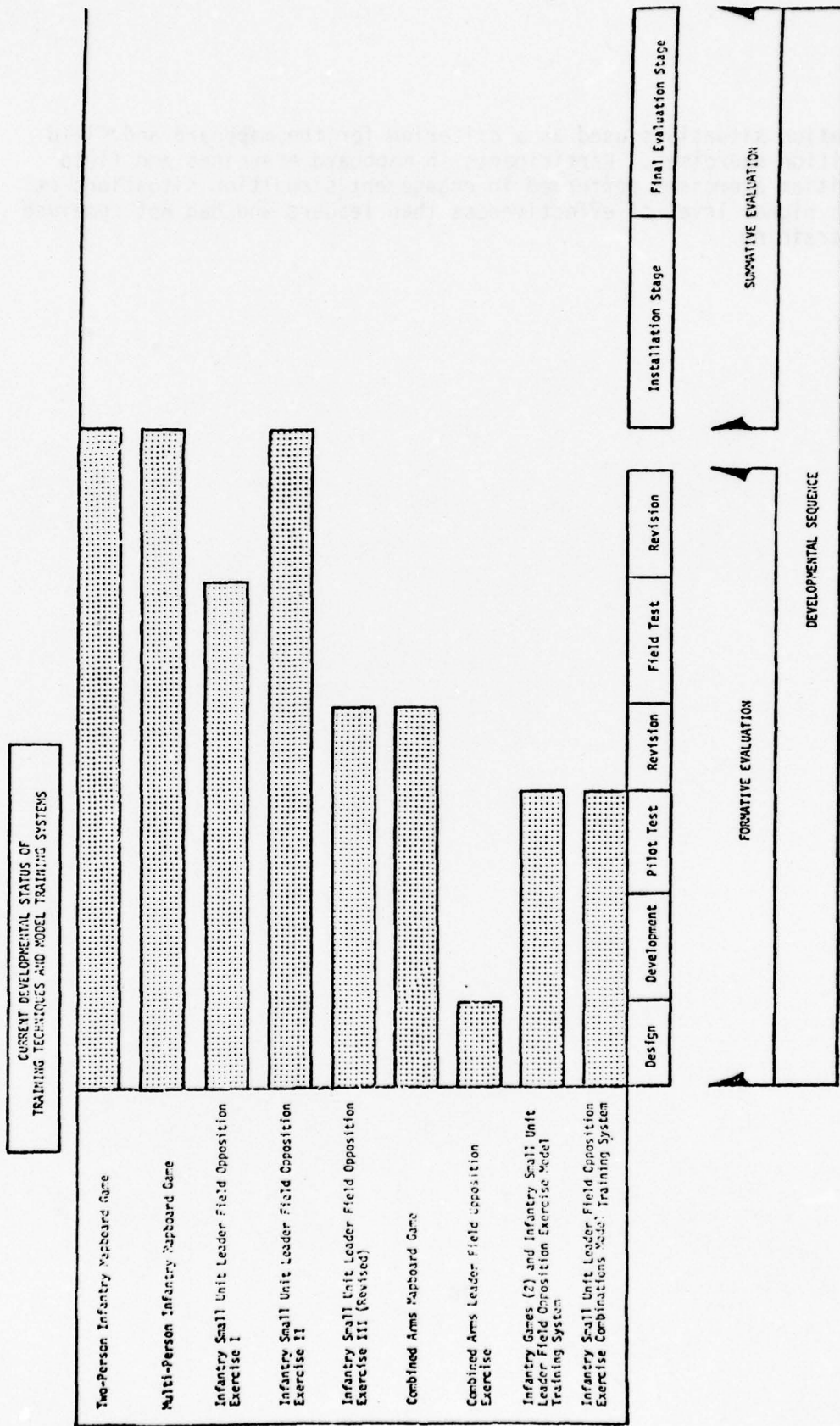


Figure 1. CURRENT DEVELOPMENTAL STATUS OF TRAINING TECHNIQUES AND MODEL TRAINING SYSTEMS

simulation situations used as a criterion for the mapboard and field opposition exercises. Participants in mapboard exercises and field opposition exercises performed in engagement simulation situations at a much higher level of effectiveness than leaders who had not received this training.

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APPENDIX A

FORT LEWIS FIELD TEST
AND
BERLIN FIELD TEST

COMPARISON OF EFFECTIVE/INEFFECTIVE BEHAVIORS

Fort Lewis Field Test

Comparison of Effective/Ineffective Behaviors

Battle #4

Control Officer - Attack Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned for reconnaissance element to precede main body to provide early warning and information about the enemy. Subsequent action and platoon attack would be formulated from intelligence.

INEFFECTIVE BEHAVIORS

I Planning

1. Platoon leader did not plan for artillery support for reconnaissance element.
2. Platoon leader did not give reconnaissance patrol instructions on how to respond in the event of unexpected contact.
3. Platoon leader did not issue orders concerning platoon actions upon contact. Tentative attack plans were not developed. Instructions were that attack plan would be formulated as events occurred.
4. Contingency plans for reorganization in the event of troop or leader casualties were not developed.
5. Alternative means of communication were not planned in the event contact with platoon was lost.

EFFECTIVE BEHAVIORS

II Execution

INEFFECTIVE BEHAVIORS

II Execution

1. Reconnaissance patrol made contact and took casualties. Did not give platoon leader a complete situation report.
2. Reconnaissance patrol tried to overrun enemy position. Took heavy casualties. Neither artillery fire nor reinforcements were requested.
3. Patrol began to pull back but were met by main body; lead elements of the platoon were taken under enemy fire. Casualties were taken.
4. Platoon was committed into an unnecessary contact situation. Lead elements were taken by surprise. Enemy positions were not pinpointed.
5. Confused rather than coordinated attack took place. Support and maneuver elements were not coordinated; attack became an individual and small group action. Casualties were heavy.
6. Platoon leader never used artillery to support ground attack.
7. Defending force employed heavy artillery fire against attacking force. Platoon leader became a casualty. Platoon remained disorganized and uncontrolled.
8. Platoon command was not re-established.

EFFECTIVE BEHAVIORS

INEFFECTIVE BEHAVIORS

9. Remainder of platoon moved ahead, trying to evade artillery fire with no security.
10. Platoon (-) ran into another enemy strong point. State of confusion existed. Sporadic attempts to dislodge enemy resulted in more casualties.
11. Unit no longer existed (2 survivors). Platoon was still 200 meters from main enemy position.

Fort Lewis Field Test

Comparison of Effective/Ineffective Behaviors

Battle #5

Experimental Officer - Attack Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned to send a forward element across a danger area to secure other side.
2. Once secure, the reconnaissance element was to move forward of the main body, which would then move into area cleared by reconnaissance element (movement by bounds).
3. Reconnaissance element was to locate and eliminate enemy snipers/observation post.
4. Reconnaissance element was to locate enemy main force.
5. A fire mission was planned for the far side of initial danger area to support advance of forward security element.
6. Artillery support was planned to be provided reconnaissance element in the event of contact.
7. Reinforcement of reconnaissance element was provided for.

INEFFECTIVE BEHAVIORS

I Planning

1. The assault mission assigned to reconnaissance element was in conflict with the purpose of a reconnaissance mission.
2. Alternate means of communication was not planned in the event contact with patrol was lost.
3. Actions of platoon in case of heavy contact was not planned.
4. An initial plan for a platoon attack against any main enemy positions was not developed.

EFFECTIVE BEHAVIORS

II Execution

1. Artillery fire was placed on far side of danger area.
2. Forward element moved forward to secure other side.
3. Element made contact and called for artillery to eliminate resistance.
4. Element called for reinforcements. Sniper position was overrun.
5. Attack force discovered observation post, cut communication wire.

INEFFECTIVE BEHAVIORS

II Execution

1. Platoon leader did not send reconnaissance element forward after sniper position was overrun. Main body moved forward without adequate security.
2. Attack element allowed observation post to escape.
3. Platoon leader did not react appropriately to locating observation post which suggested main enemy position was nearby:
 - Platoon leader did not send probing elements forward to pinpoint enemy positions.
 - Platoon leader did not prepare a detailed attack plan with fire support and maneuver elements.
 - Artillery support did not coordinate with ground attack, nor plan to precede ground attack.
4. Attack forces engaged main bunker complex without coordinated attack. Fire support and maneuver elements had not been designated. Attack consisted of individual and small group actions. Platoon leader was not in control.
5. Platoon leader called for artillery support while platoon was in contact. Friendly killed in Action resulted.

EFFECTIVE BEHAVIORS

INEFFECTIVE BEHAVIORS

6. Platoon leader became a casualty. No one assumed control of the attack.
7. Platoon took heavy casualties from defenders. Final protective fires.

Fort Lewis Field Test

Comparison of Effective/Ineffective Behaviors

Battle #7

Control Officer - Defense Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned to install booby trapped claymores (mechanical ambush) to cause enemy casualties.
2. Three sniper positions were to be placed forward of primary positions to:
 - Communicate observations to platoon leader
 - Inflict casualties but not become decisively engaged.
 - Call for artillery against attacking force.
 - Withdraw to primary positions when enemy pressure became too great.
3. Platoon leader planned for main positions to be supported by claymores. Preplanned fires were to be registered.

INEFFECTIVE BEHAVIORS

I Planning

1. Mechanical ambush was not planned for a location observable by snipers.
2. Mechanical ambush was not registered with preplanned fires.
3. Platoon leader did not establish alternate means of communication.
4. Snipers were given two conflicting roles: to inflict casualties by rifle fire and call artillery. Once a sniper engaged he decreased his ability to remain an effective forward observer.
5. Snipers were to remain in position until they came under heavy pressure. These instructions made the sniper positions vulnerable to their own indirect fire if they held contact as ordered.
6. Defensive platoon leader expected three man sniper team (30% of the force) to occupy their primary positions before the main attack was launched. His initial instructions were contradictory to his overall intentions.
7. Contingency plans for enemy breakthrough were not developed.

EFFECTIVE BEHAVIORS

II Execution

1. Snipers engaged enemy reconnaissance element/called for indirect fire.

INEFFECTIVE BEHAVIORS

II Execution

1. Snipers engaged enemy attack force within range of their own indirect fire resulting in one friendly Killed In Action to artillery.
2. Snipers revealed their position when they engaged attacking force. As they remained in position to engage and call artillery fire they became enveloped.
3. Remaining two snipers were cut off from friendly positions.
4. Wire communications were severed by attacking force. This totally isolated sniper element.
5. Defending platoon leader had no further means to track enemy movements or to decrease enemy strength.
6. Platoon leader did not call for his final protective fires.
7. Platoon leader did not reorganize defense to plug gap caused by missing men from sniper element.
8. Platoon leader became casualty and no one assumed command (contingency preparation not established to direct the defense).

Fort Lewis Field Test

Comparison of Effective/Ineffective Behaviors

Battle #10

Experimental Officer - Defense Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned for booby trap claymores (mechanical ambush) 50/100 meters to front of observation post/forward observer to:
 - Cause enemy casualties.
 - Provide early warning to forward observer/observation post.

2. Forward observer/observation post planned at 400 meters to front of main position to:
 - Communicate observations to platoon leader.
 - Remain undetected
 - Direct artillery fire against enemy force.

3. Ambush element planned at 200-250 to front of main positions to:
 - Report enemy sightings.
 - Ambush/neutralize as many enemy as possible.
 - Withdraw to primary positions.

INEFFECTIVE BEHAVIORS

I Planning

1. Platoon leader did not provide for alternate means of communication.
2. Platoon leader did not register ambush location with preplanned fires.
3. Platoon leader did not develop contingency plan if attack force bypassed ambush.

EFFECTIVE BEHAVIORS

4. Mechanical ambushes planned at 100 meters to front of main positions and to be registered.
5. Main positions planned to be supported by claymores.

II Execution

1. Observation post/forward observer spotted a reconnaissance element, called for artillery. Reported fire mission effective, element took casualties.
2. Ambush inflicted heavy casualties on attack force.
3. Final protective fires called in on attack force.
4. Remnants of attack force killed at bunker complex.

INEFFECTIVE BEHAVIORS

II Execution

1. Fire called against unobserved targets. Communication between leader and subordinate not clear. Leader thought artillery was being employed against main force.
2. Platoon leader directed forward observer/observation post to take on sniper role. He soon engaged enemy and was killed.
3. Observation post/forward observer could have been maintained as an observation post to keep track of enemy movement or massing of main force. Platoon leader unaware of enemy movement. Radio was lost.
4. Did not employ artillery against disorganized enemy forces at ambush site.

Berlin Field Test

Comparison of Effective/Ineffective Behaviors

Battle #1

Experimental Officer - Attack Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned for a reconnaissance to locate main enemy force and pinpoint disposition of that force. Reconnaissance force was not to become decisively engaged.
2. Movement and coordination between the reconnaissance point and platoon was to be accomplished by a series of phaselines, checkpoints, with radio.
3. Reinforced reconnaissance element was to maintain 200-250 meters distance from platoon assault force to minimize the effects of enemy artillery.
4. Once disposition of enemy force was pinpointed indirect fire would be utilized to destroy enemy element.
5. Ground assault would follow artillery barrage to overrun pockets of resistance. Tentative assault plan developed.

INEFFECTIVE BEHAVIORS

I Planning

1. Contingency plans for reorganization in event of leader casualties were not developed.
2. Actions upon unexpected enemy contact were not fully developed.

EFFECTIVE BEHAVIORS

INEFFECTIVE BEHAVIORS

II Execution

II Execution

1. Reconnaissance element moved ahead of main body maintaining excellent security.
2. Reconnaissance element located enemy complex. Contact was made but reconnaissance element extracted itself before it became decisively engaged.
3. Disposition of enemy force was accurately reported to platoon leader.
4. Heavy artillery fire employed against enemy bunker complex.
5. Immediately following artillery barrage reconnaissance element attacked left flank of the bunker complex overrunning the machine gun bunker.
6. Reconnaissance element, once a foot hold had been established, ran artillery support mission at the far end of the complex.
7. Platoon leader linked platoon up with reconnaissance force. A coordinated ground attack utilizing maneuver and fire support elements was launched from the flank and rear against the remaining bunkers, eliminating resistance.
8. The direction of the assault neutralized employment of claymore mines which were at the front of the complex.
1. Reconnaissance element conducted assault against bunker complex without support of the main attack force.

Berlin Field Test

Comparison of Effective/Ineffective Behaviors

Battle #4

Control Officer - Attack Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned for a point element to move ahead of the main body for security.
2. Movement of platoon and point element was to be controlled by check points and phaselines.
3. Phaselines were to be preregistered to facilitate use of supporting artillery.
4. Platoon leader planned to reinforce point element if contact was encountered.

II Execution

INEFFECTIVE BEHAVIORS

I Planning

1. Platoon leader did not develop tentative platoon assault plan or possible actions in the event of heavy contact.
2. Platoon leader did not develop contingency action plan in event of troop and leader casualties.

II Execution

1. When point element moved forward and made contact platoon leader did not reinforce the point as planned. Point suffered heavy casualties.
2. New point element was not established. Element moved forward without good forward security.

EFFECTIVE BEHAVIORS

INEFFECTIVE BEHAVIORS

3. Platoon was attacked successfully from the rear--rear security had not been provided.
4. Platoon leader directed heavy amounts of artillery on unobserved targets with no effect.
5. Platoon became heavily engaged due to lack of forward security. Enemy positions had not been pinpointed so the heavy contact was a surprise.
6. Platoon leader lost control. Platoon was committed along an entire front fighting in small elements. No command or control was established. No coordinated effort to disengage and employ supporting artillery took place.

Berlin Field Test

Comparison of Effective/Ineffective Behaviors

Battle #6

Experimental Officer - Defense Operation

EFFECTIVE BEHAVIORS

I Planning

1. Platoon leader planned three lines of sniper positions forward of main defense fortifications (each line consisted of three positions).
2. Sniper positions were to engage enemy elements to cause them to deploy. Positions were to be reinforced by command and mechanical claymore ambushes.
3. Indirect fire would be called against enemy force once it was deployed.
4. Snipers were not to become decisively engaged and were to withdraw to primary bunker positions once enemy began deploying.
5. Center sniper positions were to communicate with platoon leader by radio or wire to report contact.

INEFFECTIVE BEHAVIORS

I Planning

1. Platoon leader did not develop contingency plans in case center sniper positions were eliminated or a communications failure occurred.
2. Platoon leader did not fully develop artillery support. Preregistered fires were not preplanned to front of sniper positions.

EFFECTIVE BEHAVIORS

6. Positions were to relay fire missions through platoon leader.
7. Main bunker positions were planned with overhead cover supported by claymore mines.
8. Final protective fires were registered.

II Execution

1. When contact developed along first line of sniper positions indirect fire was delivered to front of center sniper position against advancing enemy. Enemy suffered moderate casualties to indirect fire.
2. At third defensive line, deployed snipers engaged enemy. Actions along this line were accurately reported to platoon leader. Heavy artillery fire on stalled attack force resulted in heavy casualties. Attack force ceased to be an effective fighting unit.

INEFFECTIVE BEHAVIORS

II Execution

1. Artillery support was needed at other sniper positions but was not available.
2. Two sniper positions became decisively engaged and were Killed In Action. Interaction between platoon leader and deployed elements was not adequate to execute original plan.
3. Execution of plan along second defense line broke down from faulty communications. Contingency plans for implementing a coordinated delaying action by these elements with artillery support had not been developed. After light contact enemy attack force moved forward. Friendly Killed In Action occurred.

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